STANDARD FORM NO. 64

Office Memorandum • UNITED STATES GOVERNMENT

TO : The Files - Contract 605, Task Orders 6 and 8 DATE: 21 December 1959

FROM : [redacted] 25X1

SUBJECT: Trip Report - [redacted] 25X1

1. On 17 December 1959 the writer visited the [redacted] 25X1
[redacted] to monitor progress on Tasks 6 and 8 25X1
of Contract 605 and to discuss new developments in the field of logarithmically periodic structures.

2. 30 to 1,000 mc Antenna, 605, Task Order 6 - Progress on the development of this antenna system is very satisfactory. The structure will be essentially two dimensional and will maintain VSWR's below 2.5:1 over better than 30:1 frequency coverage with gains on the order of 5 db/dipole. The boom is sectionalized in such a manner that if operation over only a portion of the range of 30 to 1,000 mc is desired, only that section may be operated. Tests at [redacted] have 25X1
indicated that complete LP structures in the form of trapezoids will operate as well as more conventional structures in the form of triangles. Attached is a picture of the antenna structure which will illustrate the general form of the antenna.

3. Antenna-Filter-Detector System, 605, Task Order 8 - The main problems associated with the 50 to 500 mc body worn antenna are largely solved. [redacted] is experimenting with a structure with only half the 25X1
width of conventional LP structures which should maintain the same performance as a full sized LP antenna in half the area. We are guaranteed delivery of the original model. In the event that the compressed structure can be developed in time, we will receive an antenna only half the size of the one presently under development. The printed circuit LP antenna covering 500 to 10,000 mc is developed and seems to work very well. Problems in registration of the two half-structures during the printed circuit photographing have been largely solved by the PC department of [redacted] The majority of the present R+D effort 25X1
is being directed towards the development of a good set of band pass filters to cover 50 to 10,000 mc. An IBM 650 computer is being used to solve the polynomial equations for these filters. Because of the 60 db/octave fall off outside the pass band which we required, the equations are of the 29th order. A complete solution for a given bandwidth takes approximately 30 hours on the computer to find all 29 roots. Some sets of equations have come out already and physically realizable designs have resulted. The filters for the range of 10,000 to 40,000 mc

[redacted] 25X1

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consist of a slab of high dielectric constant material inserted in the waveguide of the SHF antenna system. The difficulty in procuring materials of the proper dielectric constants has hindered the work somewhat, but [redacted] is sure that they have the problem solved. 25X1
Detectors made by [redacted] seem to be the best available. [redacted] 25X1
[redacted] detectors proved to be of very poor quality in comparison. 25X1
Our sensitivity figures of -65 dbm, approximately, cannot be met with the use of a VA-9 amplifier. In a dynamic demonstration [redacted] was 25X1
able to demonstrate that pulse stretching did not occur in the VA-9's until a signal input of approximately -43 dbm. Such performance will greatly hinder the sensitivity of the resulting system unless a method can be found to produce pulse stretching in the VA-9's at a much lower signal level. [redacted] feels that 15 to 20 db more gain at the input 25X1
to the VA-9 would cure the problem.

4. New LP Antennas - [redacted] has developed a method of cavity 25X1
backing LP antennas for higher gain. The conventional cavity increases depth as the frequency decreases, thus forming a pyramidal shaped cavity under the LP antenna. Clearly at 500 mc this would produce a quarter wave cavity depth of about 8 inches, more than could be tolerated for [redacted] 25X1
[redacted] antennas. Filling the cavity with a material of dielectric constant 25X1
k however will decrease the required cavity depth by $k^{\frac{1}{2}}$. With certain ceramic materials presently available, cavity depth reductions of from 4:1 to 5:1 should be possible. Filling the cavity with water will produce a depth reduction of almost 10:1. The implications of this are very interesting. First, a [redacted] antenna operating down to about 25X1
50 mc might be built which would maintain unidirections patterns and which would not be affected by the [redacted] The temperature of the [redacted] 25X1
[redacted] would hold the dielectric constant of the water constant enough to 25X1
maintain the desired pattern characteristics. [redacted] 25X1
Tests
at [redacted] have indicated that such loaded cavity antennas will maintain 25X1
their LP pattern and VSWR characteristics over very wide bands.

5. New LP Structures - [redacted] are 25X1
working on circuits having logarithmically periodic properties. The most promising design at present is an LP antenna multicoupler which would break up the output of an LP antenna into bands for use with narrow band receivers. The coupler consists of a transmission line shunted with series tuned circuits whose frequencies vary in a log periodic manner. Between each pair of tuned circuits a tap is inserted in the line to extract all energy below the cut-off frequency of the next series tuned circuit. A high pass filter inserted in the tap output will then select only a given band of frequencies. This system would allow the use of several receivers of different frequency coverage on the same LP antenna.

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[redacted] is considering the design of a log periodic traveling wave tube amplifier. They are quite certain that the use of a tapered log periodic helix in place of the more conventional TWT helices, coupled with production of very slow waves to allow sufficient interaction between the electron stream and the EM wave, will produce a TWT of much more than 2:1 bandwidth. [redacted] is unwilling to sponsor the tube development themselves and they readily admit that such a program would be very expensive. 25X1 25X1

6. Slow Wave Antennas and Beam Steerable Arrays - [redacted] has interest in slow wave dielectric antennas and electronically steered arrays. Most of the information available at [redacted] on dielectric antennas is in the form of research reports covering work by other companies. [redacted] has done some work in building electrically scanned frequency dependent antennas. They know of no method to electrically scan an antenna using a constant frequency. Following is a list of references provided by [redacted] on these two subjects: 25X1 25X1 25X1 25X1

"Coupled Waveguide Excitation of Traveling Wave Slot Antennas", Walter W. Weeks, 1 December 1957, AF-33 (616)-3220, WADC, University of Illinois Antenna Lab Report #27.

"Use of a Coupled Waveguide in a Traveling Wave Scanning Antenna", Robert Henry MacPhie, AF-33(616)-6079, WADC, University of Illinois Antenna Lab Report #36.

"Distributed Coupling to Surface Wave Antennas", Ralph R. Hodges, Jr., AF-33(616)-3220, WADC, University of Illinois Report #15.

Paper 5.2-1 of Technical Papers of Sixth Annual East Coast Conference of Aeronautical and Navigational Electronics.

Abstracts of the Ninth Annual Symposium of the United States Air Force Antenna Research and Development Program sponsored by WADC and U. of Illinois, and held in Monticello, Illinois.

[redacted] 25X1

Attachment:
[redacted] Drawing of LP Antenna 25X1

Distribution:
~~R+D~~ Subject File, w/attachment
R+D Lab w/o attachment
Monthly (2) w/o attachment
EP Chrono w/o attachment

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ROUTING AND RECORD SHEET

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SUBJECT: (Optional)

Trip Report - [redacted] 25X1

FROM: OC-E/R+D-EP

NO.

DATE: 21 December 1959

TO: (Officer designation, room number, and building)	DATE RECEIVED	DATE FORWARDED	OFFICER'S INITIALS	COMMENTS (Number each comment to show from whom to whom. Draw a line across column after each comment.)
1. R+D	1/1	1/15		Information 25X1
2. OC-SP 18 JAN 1960				
3. SPS/EA	19 JAN 1960	27 JAN		> Worth very close reading by both AF & EA pers.
4. SPS/AF				
5. OC-E - 1		2-15		Information
6. OC-E -				
7. EP [redacted]				- see me re: 1: arranging for [redacted] 25X1 see [redacted] re TWX [redacted] ILLEGIB
8. TAP				"Fuelpond" LP for HF.
9. EP				Filing
10.				
11.				
12.				
13.				
14.				
15. SECRET				

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